CITY OF SCOTTSDALE

Drainage Reports

PRELIMINARY DRAINAGE REPORT
FOR
BLACK ROCK COFFEE – 7000 EAST SHEA

30-DR-2020

Scottsdale, Arizona

24 November, 2020

Plan # _____

Case # 30-DR-2020

Q-S # _____

x Approved

____ Corrections

Richard M. Anderson 01/11/2021

Reviewed By Date

PREPARED FOR

Vertical Design Studios
4650 East Cotton Center Boulevard
Phoenix, Arizona 85040

DEVELOPER

SimonCRE
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SITE ADDRESS

7000 East Shea Boulevard
Scottsdale, Arizona 85254

PREPARED BY

CYPRESS CIVIL

4450 north 12th street, #228
phoenix, arizona 85014
CYPRESS # 19.131

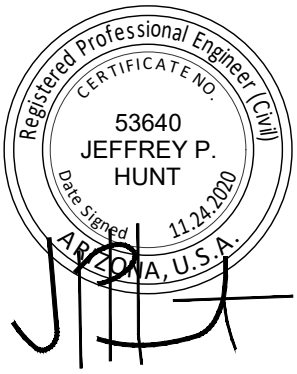


TABLE OF CONTENTS

I. INTRODUCTION

1. PROJECT NAME AND LOCATION

The Project is known as 'Black Rock Coffee – 7000 East Shea' and is located at 7000 East Shea Boulevard in Scottsdale, Arizona. The project is located in the northeast ¼ of Section 35, Township 2 North, Range 4 East, G&SRM. The Project site occupies approximately 1.33 acres. The Project is currently developed with an existing retail building and parking lot. The Project has street frontage and access to Scottsdale Road along its western boundary and pedestrian access to Shea Boulevard along its southern boundary. To the east and north are existing commercial developments. Refer to Appendix A for Location Map and Aerial Photo.

2. PURPOSE

The intent of this Drainage Report is to provide the conceptual drainage scheme for the Project in support of the Preliminary Improvement Plan Submittal.

3. EXISTING STUDIES

The Project site lies within the Lower Indian Bend Wash Area Drainage Master Study (ADMS). The ADMS has a current Flo2D model, which shows a peak flow of 32.89 CFS within 70th Street and a peak flow of 22.85 CFS within Shea Boulevard adjacent to the site. The Project lies within the Scottsdale Promenade shopping center. As-built plans were obtained. These show that there is no onsite retention. There is one existing inlet onsite that drains to the city storm drain system. Refer to Appendix B for Street Capacity Calculations.

4. FEMA FLOOD ZONE

According to the Federal Emergency Management Agency Flood Insurance Rate Map, panel number 04013C1760L dated October 16, 2013, the parcel is located in the Zone X (shaded) Area, which is defined as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. Refer to Appendix C for FEMA FIRM Map.

II. EXISTING DRAINAGE INFRASTRUCTURE

1. OFFSITE

Refer to Appendix B for Street Capacity Calculations, which show that 70th Street is sufficient to contain all flow within the right-of-way without entering the site. Thus, offsite flows do not impact the Project. However, the site does discharge some onsite flow offsite to the adjacent drive aisles and streets.

2. ONSITE

The Project has one onsite inlet, which accepts runoff from a portion of the site. This inlet conveys onsite runoff to the city storm drain system. Runoff the rest of the site discharges north and west to the adjacent streets and a small portion of the southeast corner drains east onto the adjacent property. Refer to Appendix D for the Existing and Proposed Conditions Watershed Maps and Calculations.

III. PROPOSED DRAINAGE INFRASTRUCTURE

1. CONVEYANCE OF RUNOFF

Runoff from the eastern drive aisle and the new building shall continue to be captured by the existing catch basin and conveyed to a small existing surface retention basin before overflowing to 70th Street. The discharge to this existing catch basin shall remain the same and discharge to 70th Street and Shea Boulevard shall be decreased. Discharge from the southeast corner to the adjacent eastern parcel shall remain the same.

The new onsite parking area is designed to drain via shallow sheet flow to a new catch basin and enter a new onsite underground stormwater retention chamber system within the parking lot. Refer to Appendix D for the Existing and Proposed Conditions Watershed Maps and Calculations to verify that the proposed conditions shall improve on the existing condition and meet the pre-versus-post retention requirements.

2. STORM WATER RETENTION REQUIREMENTS

The Project shall maintain the same discharge to the eastern property, decrease discharge to the adjacent streets, and shall continue to discharge runoff to the existing catch basin in the drive-thru aisle. The Project shall improve on the existing condition by increasing landscaped areas and decreasing the runoff coefficient. Thus, the pre-versus-post retention requirement shall be zero and no new retention shall be installed on site. Refer to Appendix E for Retention Calculations.

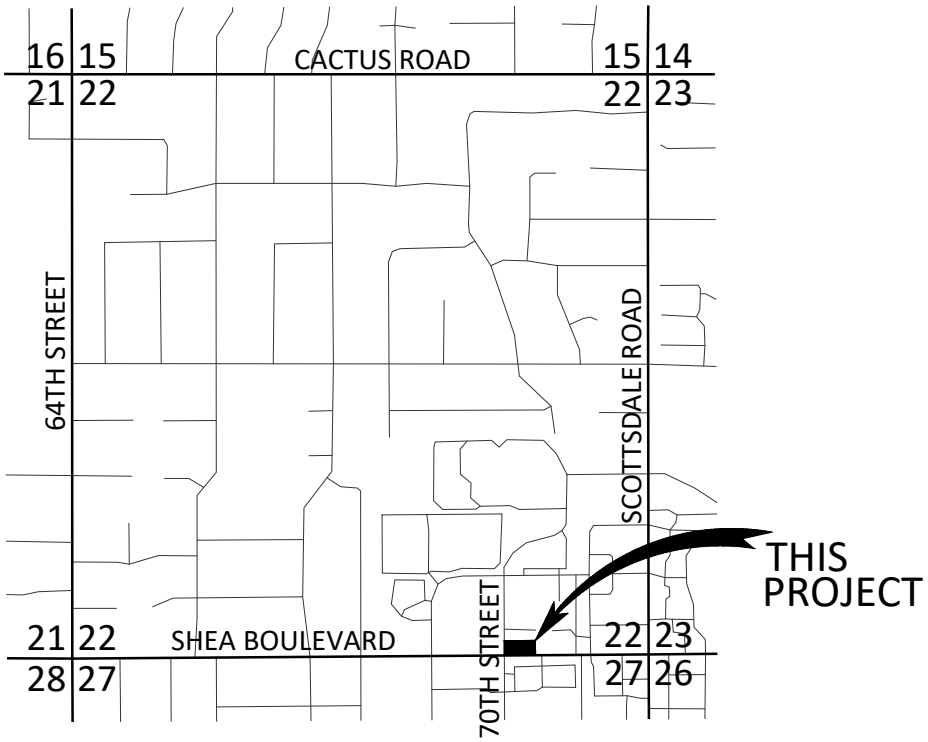
IV. SUMMARY AND CONCLUSION

This Drainage Report is to accompany the Preliminary Improvement Plan for Black Rock Coffee – 7000 East Shea development project. This narrative was written utilizing generally accepted engineering practices and all information herein has been researched through archived documents and all calculations were accomplished through applying the City of Scottsdale Engineering Standards.

The analysis presented in this narrative evaluates storm water runoff resulting from a statistical evaluation of storm events of particular duration and frequency up to and

including a 100-year frequency event. A storm event exceeding the 100-year frequency may cause or create the risk of greater flood impact than is addressed and presented herein. The scope of this assessment does not include evaluation of storm water runoff resulting from storm events exceeding the 100-year frequency. CYPRESS assumes no responsibility for actual flood damage, increased risks of flood damage, or increased construction or development cost resulting from or related to any such events, nor shall CYPRESS be responsible for any changes in, or additions to, regulatory requirements which may result from, or be related to, any such events or changes in hydrologic or hydraulic conditions within the watershed.

APPENDIX A
(Location Map + Aerial Photo)



IN THE SE 1/4 OF THE SE 1/4 OF SECTION 22,
T. 3 N., R. 4 E., G.&S.R.M.,
CITY OF SCOTTSDALE, MARICOPA COUNTY, ARIZONA

LOCATION MAP

NORTH

AERIAL PHOTO

APPENDIX B
(Street Capacity Calculations)

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 24 2020

70th Street HWE

User-defined

Invert Elev (ft)	= 51.55
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

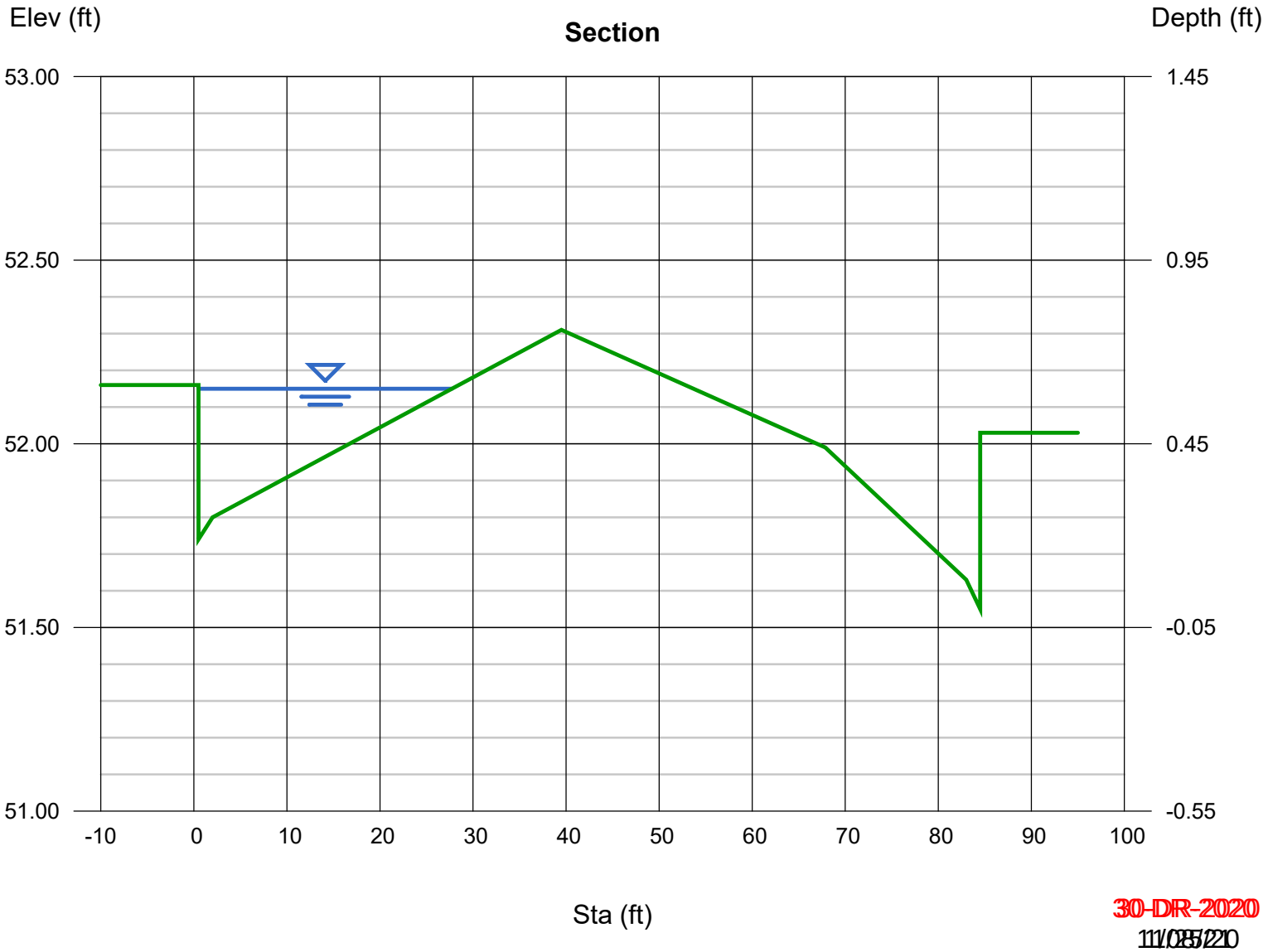
Compute by:	Known Q
Known Q (cfs)	= 32.89

Highlighted

Depth (ft)	= 0.60
Q (cfs)	= 32.89
Area (sqft)	= 12.26
Velocity (ft/s)	= 2.68
Wetted Perim (ft)	= 59.46
Crit Depth, Yc (ft)	= 0.61
Top Width (ft)	= 58.55
EGL (ft)	= 0.71

(Sta, El, n)-(Sta, El, n)...

(0.00, 52.16)-(0.50, 52.16, 0.013)-(0.50, 51.74, 0.013)-(2.00, 51.80, 0.013)-(39.50, 52.31, 0.013)-(67.86, 51.99, 0.013)-(83.00, 51.63, 0.013)
-(84.50, 51.55, 0.013)-(84.50, 52.03, 0.013)-(85.00, 52.03, 0.013)



30-DR-2020
11/05/20

APPENDIX C
(FEMA FIRM Map)

National Flood Hazard Layer FIRMette

FEMA

111°56'2"W 33°35'12"N

111°55'24"W 33°34'42"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

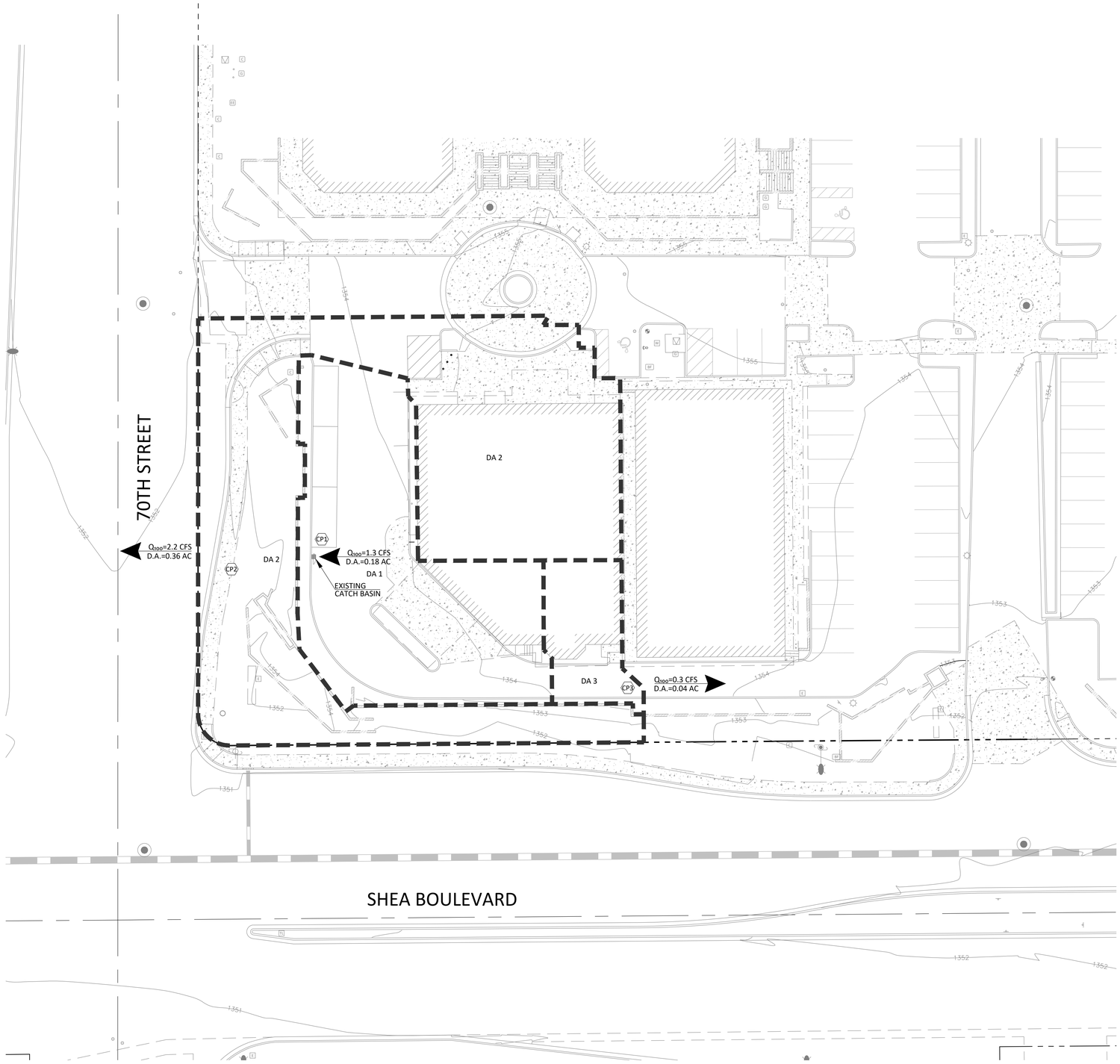
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/26/2020 at 7:33 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas c regulatory purposes.

30-DR-2020

11/05/2020

APPENDIX D
(Existing and Proposed Conditions Watershed Maps + Calculations)



WATERSHED
CONCENTATION POINTS

ID	AREA	Q 100
CP1	0.18 AC	1.3 CFS
CP2	0.36 AC	2.2 CFS
CP3	0.04 AC	0.3 CFS

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CYPRESS CIVIL

BLACKROCK COFFEE - 7000 EAST SHEA
EXISTING CONDITIONS HYDROLOGY MAP

JOB NO.: 19.131
SHEET NUMBER
1 OF 2

30-DR-2020
11/05/20

CYPRESS CIVIL

SITE CONSULTING
SURVEY
SITE ENGINEERING

EXISTING WATERSHED SUMMARY

PROJECT BLACKROCK COFFEE - 7000 EAST SHEA

WATERSHED ID	CONCENTRATION POINT	AREA ROOF + PAVEMENT C= 0.95 (SF)	AREA LANDSCAPING C= 0.50 (SF)	TOTAL AREA (AC)	WEIGHTED 'C'
AREA DRAINING TO EXISTING CATCH BASIN					
DA1	1	7,025	988	0.18	0.89
DA2	3	10,104	5,436	0.36	0.79
DA3	4	1,533	80	0.04	0.93
			CONTRIBUTING AREA WEIGHTED C:	0.83	

30-DR-2020
11/05/20

CYPRESS CIVIL

SITE CONSULTING
SURVEY
SITE ENGINEERING

RATIONAL METHOD - EXISTING

PROJECT SCRUB BOT CAR WASH

$$T_C = 11.4L^{0.5}K_b^{.52}S^{-0.31}i^{-0.38} \times 60$$

$$Q = CiA$$

Tc= Time of Concentration (min)
L= Length of longest flow path (miles)
Kb= Watershed resistance coefficient
S= Watercourse slope (ft/mi)
i= rainfall intensity (in/hr)

Q = Peak discharge (cfs)
C = Runoff coefficient
i = Rainfall intensity (inch/hr)
A = Drainage area (Acres)

100-YR, 5-MIN	7.49	in/hr
100-YR, 10-MIN	5.70	in/hr
100-YR, 15-MIN	4.71	in/hr
100-YR, 30-MIN	3.17	in/hr

WATERSHED ID	CONCENTRATION POINT	L	Kb	S		i	Tc	C	i	A	Q
DA 1	1	0.04	0.04	25	0.5%	7.49	4.3	0.89	7.49	0.18	1.3
DA 2	2	0.02	0.04	55	1.0%	7.49	2.2	0.79	7.49	0.36	2.2
DA 3	3	0.01	0.04	55	1.0%	7.49	1.9	0.93	7.49	0.04	0.3

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.5821°, Longitude: -111.9304°
Elevation: 1350.42 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**2.24** (1.86-2.74)	**2.93** (2.45-3.58)	**3.95** (3.28-4.81)	**4.74** (3.92-5.76)	**5.82** (4.73-7.04)	**6.64** (5.33-7.98)	**7.49** (5.90-8.99)	**8.34** (6.47-9.98)	**9.49** (7.18-11.4)	**10.4** (7.68-12.4)
10-min	**1.71** (1.42-2.08)	**2.23** (1.87-2.72)	**3.01** (2.50-3.67)	**3.61** (2.98-4.39)	**4.43** (3.59-5.36)	**5.05** (4.06-6.07)	**5.70** (4.49-6.84)	**6.35** (4.92-7.60)	**7.23** (5.46-8.66)	**7.89** (5.84-9.47)
15-min	**1.41** (1.17-1.72)	**1.84** (1.54-2.25)	**2.49** (2.06-3.03)	**2.98** (2.46-3.63)	**3.66** (2.97-4.43)	**4.17** (3.35-5.02)	**4.71** (3.72-5.65)	**5.25** (4.06-6.28)	**5.98** (4.51-7.16)	**6.52** (4.83-7.83)
30-min	**0.948** (0.788-1.16)	**1.24** (1.04-1.52)	**1.67** (1.39-2.04)	**2.01** (1.66-2.44)	**2.46** (2.00-2.98)	**2.81** (2.26-3.38)	**3.17** (2.50-3.81)	**3.53** (2.74-4.23)	**4.02** (3.04-4.82)	**4.39** (3.25-5.27)
60-min	**0.587** (0.488-0.717)	**0.766** (0.642-0.938)	**1.04** (0.859-1.26)	**1.24** (1.03-1.51)	**1.53** (1.24-1.85)	**1.74** (1.40-2.09)	**1.96** (1.55-2.36)	**2.19** (1.69-2.62)	**2.49** (1.88-2.98)	**2.72** (2.01-3.26)
2-hr	**0.344** (0.290-0.410)	**0.444** (0.376-0.531)	**0.592** (0.498-0.704)	**0.704** (0.587-0.837)	**0.860** (0.710-1.02)	**0.976** (0.795-1.15)	**1.10** (0.878-1.29)	**1.22** (0.960-1.44)	**1.39** (1.07-1.63)	**1.52** (1.14-1.79)
3-hr	**0.255** (0.215-0.312)	**0.327** (0.277-0.401)	**0.427** (0.360-0.521)	**0.506** (0.422-0.614)	**0.618** (0.508-0.744)	**0.707** (0.573-0.847)	**0.799** (0.636-0.957)	**0.897** (0.701-1.07)	**1.03** (0.781-1.23)	**1.14** (0.842-1.36)
6-hr	**0.154** (0.132-0.183)	**0.195** (0.167-0.231)	**0.249** (0.212-0.294)	**0.292** (0.247-0.343)	**0.351** (0.293-0.410)	**0.396** (0.326-0.463)	**0.444** (0.360-0.516)	**0.493** (0.393-0.575)	**0.560** (0.434-0.652)	**0.612** (0.463-0.715)
12-hr	**0.085** (0.073-0.100)	**0.107** (0.092-0.126)	**0.135** (0.116-0.159)	**0.157** (0.134-0.184)	**0.187** (0.158-0.218)	**0.210** (0.175-0.244)	**0.233** (0.192-0.271)	**0.257** (0.209-0.299)	**0.289** (0.229-0.338)	**0.314** (0.244-0.369)
24-hr	**0.050** (0.043-0.059)	**0.063** (0.055-0.075)	**0.082** (0.071-0.096)	**0.096** (0.083-0.113)	**0.117** (0.100-0.137)	**0.133** (0.112-0.155)	**0.149** (0.126-0.175)	**0.166** (0.139-0.195)	**0.190** (0.156-0.223)	**0.209** (0.170-0.246)
2-day	**0.027** (0.023-0.031)	**0.034** (0.030-0.040)	**0.045** (0.038-0.052)	**0.053** (0.046-0.062)	**0.065** (0.055-0.075)	**0.074** (0.062-0.086)	**0.084** (0.070-0.098)	**0.094** (0.078-0.109)	**0.108** (0.088-0.126)	**0.119** (0.096-0.139)
3-day	**0.019** (0.017-0.022)	**0.024** (0.021-0.028)	**0.032** (0.028-0.037)	**0.038** (0.033-0.044)	**0.047** (0.040-0.054)	**0.054** (0.046-0.062)	**0.061** (0.052-0.071)	**0.069** (0.058-0.080)	**0.079** (0.066-0.092)	**0.088** (0.072-0.103)
4-day	**0.015** (0.013-0.018)	**0.019** (0.017-0.022)	**0.026** (0.022-0.030)	**0.031** (0.027-0.035)	**0.038** (0.033-0.044)	**0.044** (0.037-0.050)	**0.050** (0.042-0.057)	**0.056** (0.047-0.065)	**0.065** (0.054-0.076)	**0.073** (0.060-0.084)
7-day	**0.010** (0.009-0.011)	**0.013** (0.011-0.015)	**0.017** (0.014-0.019)	**0.020** (0.017-0.023)	**0.024** (0.021-0.028)	**0.028** (0.024-0.033)	**0.032** (0.027-0.037)	**0.036** (0.031-0.042)	**0.042** (0.035-0.049)	**0.047** (0.039-0.055)
10-day	**0.007** (0.006-0.009)	**0.009** (0.008-0.011)	**0.012** (0.011-0.014)	**0.015** (0.013-0.017)	**0.018** (0.016-0.021)	**0.021** (0.018-0.024)	**0.024** (0.020-0.028)	**0.027** (0.023-0.031)	**0.031** (0.026-0.036)	**0.035** (0.029-0.040)
20-day	**0.005** (0.004-0.005)	**0.006** (0.005-0.007)	**0.008** (0.007-0.009)	**0.009** (0.008-0.011)	**0.011** (0.010-0.013)	**0.013** (0.011-0.014)	**0.014** (0.012-0.016)	**0.016** (0.013-0.018)	**0.018** (0.015-0.020)	**0.019** (0.016-0.022)
30-day	**0.004** (0.003-0.004)	**0.005** (0.004-0.005)	**0.006** (0.005-0.007)	**0.007** (0.006-0.008)	**0.009** (0.007-0.010)	**0.010** (0.008-0.011)	**0.011** (0.009-0.013)	**0.012** (0.010-0.014)	**0.014** (0.012-0.016)	**0.015** (0.013-0.017)
45-day	**0.003** (0.002-0.003)	**0.004** (0.003-0.004)	**0.005** (0.004-0.005)	**0.005** (0.005-0.006)	**0.007** (0.006-0.007)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.010** (0.009-0.012)	**0.011** (0.009-0.013)
60-day	**0.002** (0.002-0.003)	**0.003** (0.003-0.003)	**0.004** (0.003-0.004)	**0.004** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.005-0.007)	**0.007** (0.006-0.008)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.007-0.010)

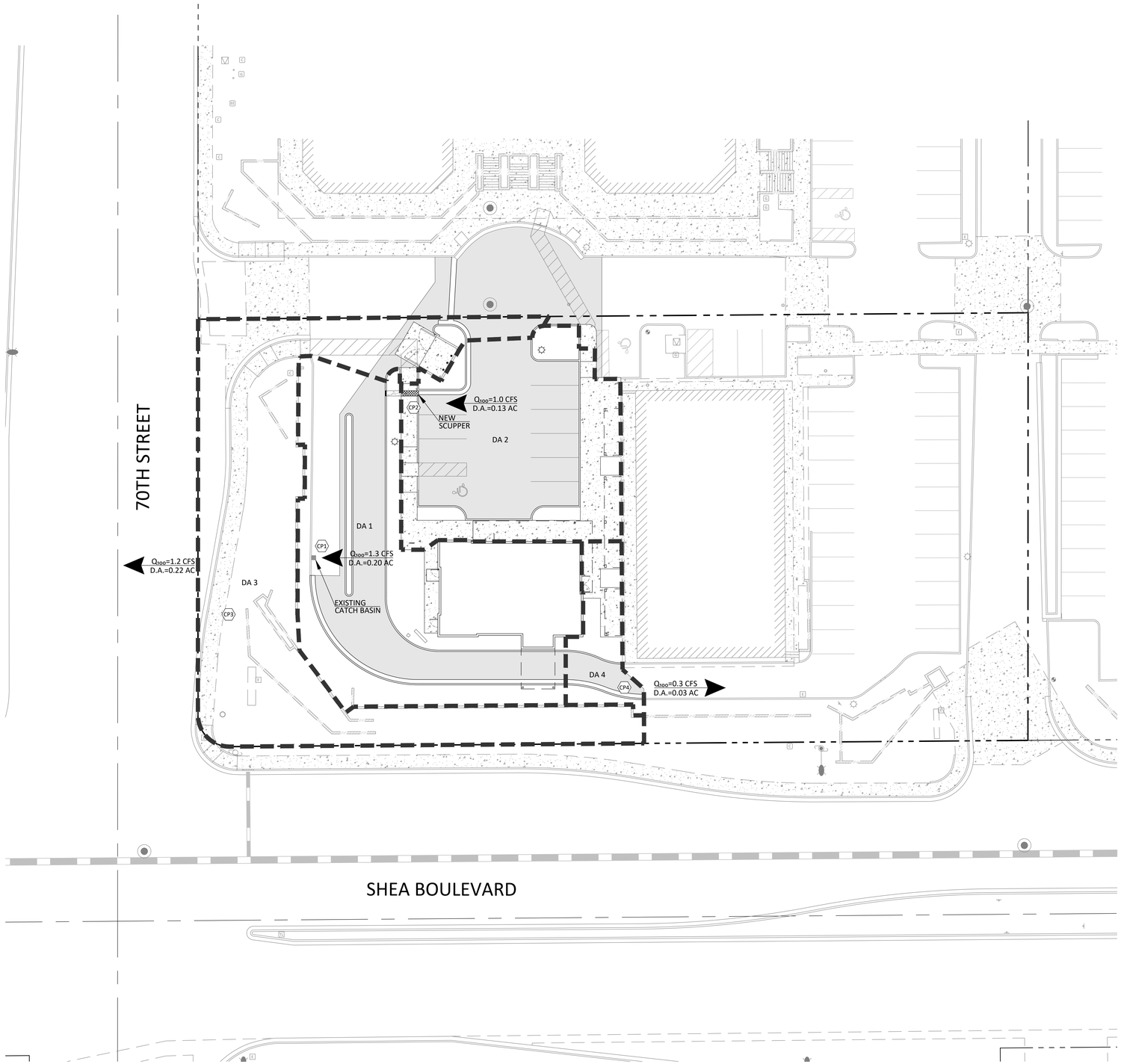
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



SCALE 1"=20'
C.I. = 1 ft

LEGEND

- EXISTING RIGHT-OF-WAY
- PROJECT/NEW PROPERTY LINE
- ROADWAY CENTERLINE
- FLOW ARROW
- WATERSHED BOUNDARY
- CONCENTRATION POINT (CP1)
- EXISTING STORM DRAIN PIPE
- NEW STORM DRAIN PIPE
- EXISTING CONTOUR (2321)

WATERSHED CONCENTATION POINTS

ID	AREA	Q 100
CP1	0.20 AC	1.3 CFS
CP2	0.13 AC	1.0 CFS
CP3	0.22 AC	1.2 CFS
CP4	0.03 AC	0.3 CFS

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CYPRESS CIVIL

BLACKROCK COFFEE - 7000 EAST SHEA
PROPOSED CONDITIONS HYDROLOGY MAP

JOB NO.: 19.131

SHEET NUMBER

OF 2

CYPRESS CIVIL

SITE CONSULTING
SURVEY
SITE ENGINEERING

PROPOSED WATERSHED SUMMARY

PROJECT BLACKROCK COFFEE - 7000 EAST SHEA

WATERSHED ID	CONCENTRATION POINT	AREA ROOF + PAVEMENT C= 0.95 (SF)	AREA LANDSCAPING C= 0.50 (SF)	TOTAL AREA (AC)	WEIGHTED 'C'
AREA DRAINING TO EXISTING CATCH BASIN					
DA1	1	6,031	2,612	0.20	0.81
DA2	2	5,231	644	0.13	0.90
DA3	3	4,116	5,370	0.22	0.70
DA4	4	707	453	0.03	0.77
			CONTRIBUTING AREA WEIGHTED C:	0.79	

30-DR-2020
11/05/20

CYPRESS CIVIL

SITE CONSULTING
SURVEY
SITE ENGINEERING

RATIONAL METHOD - PROPOSED

PROJECT SCRUB BOT CAR WASH

$$T_C = 11.4L^{0.5}K_b^{.52}S^{-0.31}i^{-0.38} \times 60$$

$$Q = CiA$$

Tc= Time of Concentration (min)
L= Length of longest flow path (miles)
Kb= Watershed resistance coefficient
S= Watercourse slope (ft/mi)
i= rainfall intensity (in/hr)

Q = Peak discharge (cfs)
C = Runoff coefficient
i = Rainfall intensity (inch/hr)
A = Drainage area (Acres)

100-YR, 5-MIN	7.49	in/hr
100-YR, 10-MIN	5.70	in/hr
100-YR, 15-MIN	4.71	in/hr
100-YR, 30-MIN	3.17	in/hr

WATERSHED ID	CONCENTRATION POINT	L	Kb	S		i	Tc	C	i	A	Q
DA 1	1	0.03	0.04	25	0.5%	7.49	4.1	0.81	7.49	0.20	1.3
DA 2	2	0.02	0.04	55	1.0%	7.49	2.2	0.90	7.49	0.13	1.0
DA 3	3	0.02	0.04	55	1.0%	7.49	2.2	0.70	7.49	0.22	1.2
DA 4	4	0.01	0.04	25	0.5%	7.49	2.4	0.77	7.49	0.03	0.2

APPENDIX D
(Retention Calculations)

PROJECT RETENTION REQUIREMENTS

$$V = C \times D \times A$$

V = VOLUME (CUBIC FEET)

C = WEIGHTED SITE RUNOFF COEFFICIENT*

*Refer to contributing watershed summary sheet

D = DEPTH OF 100-YR, 2-HR RAINFALL (FEET) = 2.20 IN

A = PROJECT AREA ABLE TO BE RETAINED (SQUARE FEET)

REQUIRED ONSITE RETENTION:

$$V = 0.90 \times \left(\frac{2.20}{12}\right) \times 5{,}875$$

$$V = 970\ CF$$

PROVIDED RETENTION IS 987 CF VIA AN UNDERGROUND STORMTECH RETENTION CHAMBER SYSTEM, WHICH WHISH IS DESIGNED TO DRAIN VIA NATURAL PERCOLATION. ONE NEW DRYWELL SHALL BE INSTALLED IF PERCOLATION TEST FINDS PERCOLATION RATE INSUFFICIENT.

APPENDIX E
(Retention Calculations)

PROJECT RETENTION REQUIREMENTS

$$V = C \times D \times A$$

V = VOLUME (CUBIC FEET)

C = WEIGHTED SITE RUNOFF COEFFICIENT*

*Refer to contributing watershed summary sheet

D = DEPTH OF 100-YR, 2-HR RAINFALL (FEET) = 2.20 IN

A = PROJECT AREA ABLE TO BE RETAINED (SQUARE FEET)

REQUIRED PRE-VERSUS-POST 100-YEAR, 2-HOUR RETENTION:

$$Vpre = 0.79 \times \left(\frac{2.20}{12}\right) \times 25{,}164 = \ 3{,}645\ CF$$

$$Vpost = 0.83 \times \left(\frac{2.20}{12}\right) \times 25{,}164 = \ 3{,}830\ CF$$

$$V = 3{,}645 - 3{,}830 = -185\ CF$$

NO RETENTION IS REQUIRED AS THE PROPOSED CONDITION SHALL LOWER THE RUNOFF COEFFICIENT AND IMPROVE ON THE EXISTING CONDITION.

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.5821°, Longitude: -111.9304°
Elevation: 1350.42 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.187** (0.155-0.228)	**0.244** (0.204-0.298)	**0.329** (0.273-0.401)	**0.395** (0.327-0.480)	**0.485** (0.394-0.587)	**0.553** (0.444-0.665)	**0.624** (0.492-0.749)	**0.695** (0.539-0.832)	**0.791** (0.598-0.949)	**0.864** (0.640-1.04)
10-min	**0.285** (0.236-0.347)	**0.371** (0.311-0.454)	**0.501** (0.416-0.611)	**0.602** (0.497-0.731)	**0.738** (0.599-0.893)	**0.842** (0.676-1.01)	**0.950** (0.749-1.14)	**1.06** (0.820-1.27)	**1.21** (0.910-1.44)	**1.32** (0.974-1.58)
15-min	**0.353** (0.293-0.430)	**0.460** (0.385-0.563)	**0.622** (0.515-0.757)	**0.746** (0.616-0.907)	**0.915** (0.743-1.11)	**1.04** (0.838-1.25)	**1.18** (0.929-1.41)	**1.31** (1.02-1.57)	**1.49** (1.13-1.79)	**1.63** (1.21-1.96)
30-min	**0.474** (0.394-0.579)	**0.619** (0.519-0.758)	**0.837** (0.694-1.02)	**1.00** (0.830-1.22)	**1.23** (1.00-1.49)	**1.41** (1.13-1.69)	**1.59** (1.25-1.90)	**1.77** (1.37-2.12)	**2.01** (1.52-2.41)	**2.20** (1.63-2.64)
60-min	**0.587** (0.488-0.717)	**0.766** (0.642-0.938)	**1.04** (0.859-1.26)	**1.24** (1.03-1.51)	**1.53** (1.24-1.85)	**1.74** (1.40-2.09)	**1.96** (1.55-2.36)	**2.19** (1.69-2.62)	**2.49** (1.88-2.98)	**2.72** (2.01-3.26)
2-hr	**0.687** (0.579-0.819)	**0.887** (0.752-1.06)	**1.18** (0.996-1.41)	**1.41** (1.17-1.67)	**1.72** (1.42-2.03)	**1.95** (1.59-2.30)	**2.20** (1.76-2.58)	**2.44** (1.92-2.87)	**2.78** (2.13-3.26)	**3.03** (2.28-3.58)
3-hr	**0.766** (0.646-0.936)	**0.981** (0.831-1.20)	**1.28** (1.08-1.57)	**1.52** (1.27-1.84)	**1.86** (1.53-2.24)	**2.12** (1.72-2.54)	**2.40** (1.91-2.87)	**2.69** (2.11-3.21)	**3.09** (2.35-3.69)	**3.41** (2.53-4.08)
6-hr	**0.924** (0.793-1.10)	**1.17** (1.00-1.39)	**1.49** (1.27-1.76)	**1.75** (1.48-2.06)	**2.10** (1.76-2.46)	**2.37** (1.95-2.77)	**2.66** (2.16-3.09)	**2.95** (2.35-3.44)	**3.35** (2.60-3.90)	**3.67** (2.78-4.28)
12-hr	**1.02** (0.882-1.20)	**1.29** (1.11-1.52)	**1.63** (1.40-1.91)	**1.89** (1.62-2.22)	**2.25** (1.90-2.63)	**2.53** (2.11-2.94)	**2.81** (2.31-3.27)	**3.10** (2.52-3.60)	**3.48** (2.75-4.07)	**3.78** (2.94-4.45)
24-hr	**1.20** (1.04-1.41)	**1.52** (1.32-1.79)	**1.96** (1.70-2.32)	**2.31** (1.99-2.72)	**2.80** (2.39-3.29)	**3.18** (2.70-3.73)	**3.58** (3.01-4.21)	**3.99** (3.33-4.68)	**4.57** (3.75-5.35)	**5.02** (4.07-5.91)
2-day	**1.29** (1.11-1.50)	**1.64** (1.42-1.92)	**2.14** (1.85-2.51)	**2.55** (2.19-2.97)	**3.10** (2.65-3.62)	**3.54** (3.00-4.13)	**4.01** (3.37-4.68)	**4.49** (3.74-5.25)	**5.17** (4.24-6.04)	**5.70** (4.62-6.69)
3-day	**1.37** (1.19-1.60)	**1.75** (1.52-2.04)	**2.30** (1.99-2.68)	**2.74** (2.37-3.19)	**3.36** (2.89-3.91)	**3.86** (3.29-4.48)	**4.39** (3.71-5.09)	**4.94** (4.14-5.75)	**5.72** (4.73-6.65)	**6.35** (5.19-7.40)
4-day	**1.46** (1.27-1.69)	**1.86** (1.63-2.16)	**2.46** (2.14-2.84)	**2.94** (2.55-3.40)	**3.63** (3.12-4.19)	**4.18** (3.58-4.83)	**4.77** (4.05-5.50)	**5.39** (4.54-6.25)	**6.28** (5.22-7.25)	**7.00** (5.76-8.11)
7-day	**1.65** (1.43-1.92)	**2.11** (1.83-2.45)	**2.79** (2.41-3.24)	**3.33** (2.87-3.87)	**4.11** (3.52-4.77)	**4.74** (4.04-5.49)	**5.41** (4.57-6.26)	**6.12** (5.13-7.11)	**7.12** (5.89-8.27)	**7.93** (6.50-9.22)
10-day	**1.77** (1.54-2.05)	**2.27** (1.98-2.63)	**3.00** (2.60-3.47)	**3.58** (3.10-4.14)	**4.40** (3.79-5.07)	**5.06** (4.33-5.82)	**5.76** (4.89-6.63)	**6.49** (5.48-7.49)	**7.53** (6.27-8.67)	**8.36** (6.89-9.65)
20-day	**2.19** (1.92-2.52)	**2.82** (2.46-3.24)	**3.73** (3.25-4.28)	**4.41** (3.84-5.06)	**5.34** (4.62-6.12)	**6.05** (5.22-6.93)	**6.77** (5.81-7.77)	**7.51** (6.41-8.63)	**8.50** (7.19-9.79)	**9.26** (7.78-10.7)
30-day	**2.57** (2.23-2.95)	**3.30** (2.88-3.80)	**4.36** (3.79-4.99)	**5.16** (4.48-5.91)	**6.23** (5.39-7.14)	**7.06** (6.08-8.07)	**7.91** (6.78-9.04)	**8.77** (7.48-10.0)	**9.93** (8.41-11.4)	**10.8** (9.10-12.4)
45-day	**2.95** (2.59-3.37)	**3.81** (3.34-4.35)	**5.01** (4.39-5.72)	**5.91** (5.16-6.74)	**7.09** (6.17-8.08)	**7.98** (6.92-9.09)	**8.88** (7.65-10.1)	**9.78** (8.40-11.2)	**11.0** (9.34-12.6)	**11.9** (10.0-13.6)
60-day	**3.24** (2.86-3.69)	**4.19** (3.69-4.77)	**5.51** (4.85-6.26)	**6.47** (5.68-7.35)	**7.72** (6.76-8.76)	**8.65** (7.54-9.81)	**9.58** (8.31-10.9)	**10.5** (9.07-11.9)	**11.7** (10.0-13.3)	**12.6** (10.7-14.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

APPENDIX F
(Warning and Disclaimer of Liability Form)